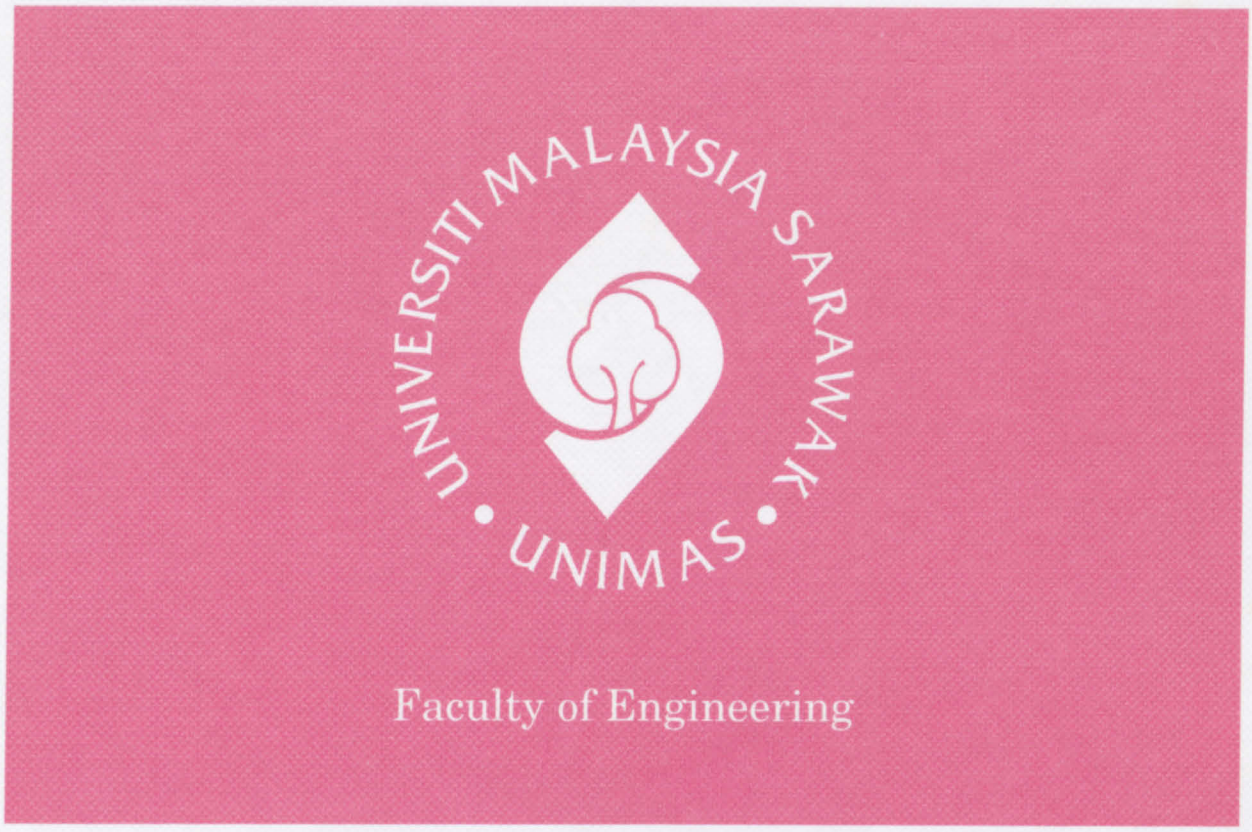

DESIGN OF PORTABLE COCONUT MILK EXTRACTOR

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SESI PENGAJIAN :2007/2008

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This project report attached here to, entitle "Design of Portable Coconut Milk Extractor" prepared and submitted by KENNETH HAMILTON ANAK MUNSANG-12125 as a partial fulfilment of the requirement for the Degree of Bachelor of Engineering with Honours in Mechanical and Manufacturing Engineering is hereby read and approve by:

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SUPERVISOR

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ABSTRACT

Coconut milk extractor is a device to extract fresh coconut milk. It becomes an alternative for conventional extracting method nowadays. This type of method is more reliable in term of processing time, hygiene, safety and requires less processing method. This thesis presents the process of design, fabrication, and experiment analysis of a portable mock up model coconut milk extractor. The target group and potential customers are busy urban society especially working housewives and Small and Medium Industries (SMI). The aim of the project is to reduce size and cost of the machine than the one which is used in this industry. Thorough extracting methods and market studies are discussed in order to improve the design. Material availability and fabrication utilities are considered in the machine prototype construction. Final testing and performance of the prototype such as the amount of coconut milk can be extracted and the efficiency of the prototype is measured. The design is hoped to be able to extract a sufficient amount of coconut milk and acts as a user friendly gadget in the kitchen hence compete against other existing machines available in the market today.

ABSTRAK

Mesin pemerah santan kelapa adalah alat yang digunakan untuk memerah santan kelapa segar. Mesin ini dijadikan sebagai salah satu alternatif kepada cara tradisional yang biasa digunakan oleh pengguna untuk memerah santan. Selalunya penggunaan mesin adalah lebih berdaya saing dari segi masa pemprosesan, kebersihan, keselamatan dan aturan pemprosesan. Tesis ini menerangkan tentang proses mereka, membina dan menganalisis eksperimen yang telah dijalankan terhadap mesin pemerah santan ini. Sasaran utama pengguna adalah mereka yang tinggal di kawasan bandar yang sibuk dan kekurangan masa untuk menyediakan sendiri santan kelapa segar. Golongan tersebut adalah seperti pengusaha Industri Kecil dan Sederhana dan suri rumah yang bekerja. Misi utama projek ini adalah untuk mengurangkan saiz dan kos mesin berbanding mesin-mesin pemerah santan yang terdapat di pasaran sekarang. Kesulitan untuk mendapatkan bahan dan proses pembuatan mesin akan dibincangkan secara menyeluruh. Ujian terhadap prestasi mesin seperti kuantiti santan yang diperolehi dan kecekapan operasi mesin akan diambil kira. Rekaan ini diharap dapat menghasilkan kuantiti santan yang mencukupi dan bertindak sebagai mesin yang mesra pengguna. Akhir sekali mesin ini berupaya untuk bersaing dengan mesin-mesin pemerah santan lain yang terdapat di pasaran pada masa kini.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Coconut is a multipurpose plant which is very important for human being. One of the benefits of coconut is its milk. The milk is a creamy substance and use to flavor the food. In Malaysia, coconut milk is popular in Malay cuisines such as curry and laksa.

Coconut milk is highly demanded especially by household users. There are some needs to obtain the fastest way of extracting coconut milk at their own house. The existing traditional way of extracting coconut milk involves a lot of process such as shredding, grating and squeezing. It seems that, this method is time and energy consuming.

Furthermore, by doing a lot of different process, this method requires a lot of tools such as knife, grater and containers. These tool especially the knife and grater can be harmful for users because of the sharp edges. Besides, by having too many tools, it will make the place become messy and the user need to do a lot of cleaning afterwards. In addition, most of household users are busy especially for those who live in the city.

The conventional method explained earlier requires a lot of involvement of bare hands in the process. Hygiene factor is a main concern since the bacteria from the hands will contaminate the milk. The bacteria will affect the quality of the milk thus making its hard to keep the milk for a long time. The use of gloves is cleaner but this way is not practical and quite fussy to be implemented.

This study is conducted to overcome the problems faced by household users regarding on the fastest way to extract fresh coconut milk. The next few chapters consist of Literature Review, Methodology, Results and Analysis will explain further on the process of developing the coconut extracting machine. It is hoped that, the findings will benefit this community so that they will be able to have a fast, easy and reliable way of extracting coconut milk at their own house.

1.2 Objective

The objective of this project is to design and fabricate a mock up model of portable coconut milk extracting machine.

1.3 Scope

The scope of this study is to develop a small and compact mock up model of coconut milk extractor. This machine is developed mainly for Malaysian users since most of the testing is done in this country. The machine can be operated in simple, hygienic and requires fast steps. In order to compete in market, the machine will be sold at competitive price.

1.4 Contributions

The development of this machine has give lots of benefit to various kind of society. This machine is useful for small coffee shop and eating outlets such as hawker stall and night market. This is because this machine can provide least processing time, compact and can be easily moved from one place to another. Since this machine uses plastic as main material the cost is affordable and at the same time still maintaining the quality and durability of the product.

Second community that will gain benefit from development of this machine is household users. This machine is developed based on what customers need such as portability, simplicity, durability and safety. It is because household users nowadays are fussy in the way they prepare their food especially working wife. This product will be a great gadget for preparing a fast, fresh and hygienic coconut milk at home.

By developing this machine, it will improve the way people extract coconut milk. With some applications of technologies, the extraction process can be simplified compared to the conventional way of extracting method which is time and energy consuming. It is assured that this machine can help busy urban society and improve method in extracting coconut milk.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This Chapter will briefly explain about the diversity of coconut since the first time it was discovered. Comparison between different varieties of coconut from all over the world is made such as differences in size, thickness and colors. Coconut Market Study will review on the world's major coconut producer and growing area worldwide. Further discussion in this chapter will leads to the process of development of coconut extracting machines and types of extracting methods currently use. Advantages and disadvantages of these methods will be highlighted together with some possible materials and prospect to be used in the design. Finally these methods will be compared based on problem statements and project scope in order to achieve desired design for coconut extracting machine.

2.2 Coconut Information

Coconut comes from palm family scientifically called "Arecaceae", a distinct family of monocotyledonous plants. It is a large palm, grow up to 30 m tall, with pinnate leaves which is 4-6 m long.[5] It is scientifically known as "cucos nucifera" with "nucifera" meaning "nut-bearing".[6] In Nicobar Islands of the Indian Ocean, coconuts were used as currency for purchasing goods in early twentieth century. [6]

In 1555, the English name "coconut" was first mentioned that comes from the Spanish and Portuguese word "coco", which means "monkey face".[6] Spanish and Portuguese explorers found a resemblance to a monkey's face in the three round indented markings or "eyes" found at the base of the coconut. "Kalpa vriksha" is the other name for coconut in Sanskrit, meaning "tree which gives all that is necessary for living," because of its multipurpose usage.[6]

Coconut has a long and unclear history due to a fact that coconuts can float on water. It spreads throughout the world because these fruits can float on the ocean for months and still able to grow when beached. The origin of coconut is subject to controversy. Some historians believe that the coconut palm came into existence in regions of Southeast Asia and some believe that it originated in the southern American region. [5]

Coconut tree usually found at sea level which is approximately 150 m (490 ft). It also will grow at 0–600 m (0–1970 ft) or near the equator rainfall 1500–2500 mm (60–100 in).[3] The tree is amazingly adaptable to a wide range of soil types as long as water logging does not occur within 1m (3.3 ft) of the surface.[3]. It is estimated that the mature coconut tree produces 50–80 fruits per palm/year.[3]

Coconut milk is well known in Malaysia as one of the most important source of food flavor. Coconut which consists of water and white flesh called meat usually use as thirst breaker during hot days. It contains lots of vitamins and recently been reported to reduce the viral load of HIV.[2] As for the meat, it is white in color can be extracted to produce the milk for flavoring dishes especially in Malay cuisines

2.2.1 Types of Coconut

There are two types of coconut which is "Tall" and "Dwarf".[3] Tall type is commonly grown variety around the world. This type has wide variation in characteristics such as size, shape, colors and fruit composition.[3] Meanwhile, dwarfs are largely self-pollinated and thus are genetically more homogeneous. That is why dwarfs have more uniform appearance among its types.[3] These two types will be explained further after this.

2.2.1.1 Tall

Tall coconut can be divided into two main types which are "Niu kafa" and "Niu vai".[3] Niu Kafa is described to be the wild type. It is characterized by elongated triangular-shaped fruits with a very small elongated nut and a high husk-to-nut ratio.[3] Niu kafa was valued by the early Polynesians for its long fibers which is used in making braided cordage known as "sennit."[3]

Because of Niu Kafa is not presently grown, it has been replaced by Niu Vai. It is classified as domestic and large-fruited type. Characteristics of the wild type can still be found in natural stands of coconuts. A whole range of nut sized and shapes exist between the two types of "niu kafa" and "niu vai".[3]

Among the tall varieties, some which have evolved in isolation from a narrow introduction becoming more homogenous. These varieties had been used in breeding program to produce improved planting materials.[3] Talls are named after the locality, island, or country in which they are found such as "West African" and "Tagnanan" from the Philippines. Characteristics that have been used to classify tall varieties include the floral biology, nut physiology, and germination time.[3]

2.2.1.2 Dwarf

Just like its name, Dwarfs are smaller in structure and produce smaller nuts but in greater numbers. They are named after their country origins like "Green Malayan", "Cameroon Red" and "New Guinea Brown" or based on the color of the fruit. This type is popular as decorative plants such as parks, gardens and roadsides.

The stems are slender and do not form boles at the base. Dwarfs maturity period is 3 years compared to 5 years for the Talls. Because of their smaller stature, homogeneity, and precocity, they are used in hybridization with Talls.[3] Dwarfs provide high density of planting but inability of dwarfs to adapt varying conditions is its drawback compared to the Talls.

"Niu Leka" is another type of dwarfs. This fruit comes from Fiji and known as "Samoan Dwarf" in Hawaii.[3] Its stem is thicker and shorter. It has short stiff fronds and large nuts. It is interesting to note that early germinators (Talls) are found in the Indo-Malayan region where coconuts are thought to have originated.[3]

2.2.2 Coconut Diversity

Figure 2.1(a) shows different types of coconut that can be found worldwide. It includes different fruit sizes, shape, colors, husk thickness and variation in kernel and cavity size. The order of the fruit name is arranged from left to right as shown in Figure 2.1(b). The country where each photograph was taken is noted in parentheses, if not the country of origin.[3] Illustration courtesy R. Bourdeix © 2005 Editions Diversiflora and CIRAD.

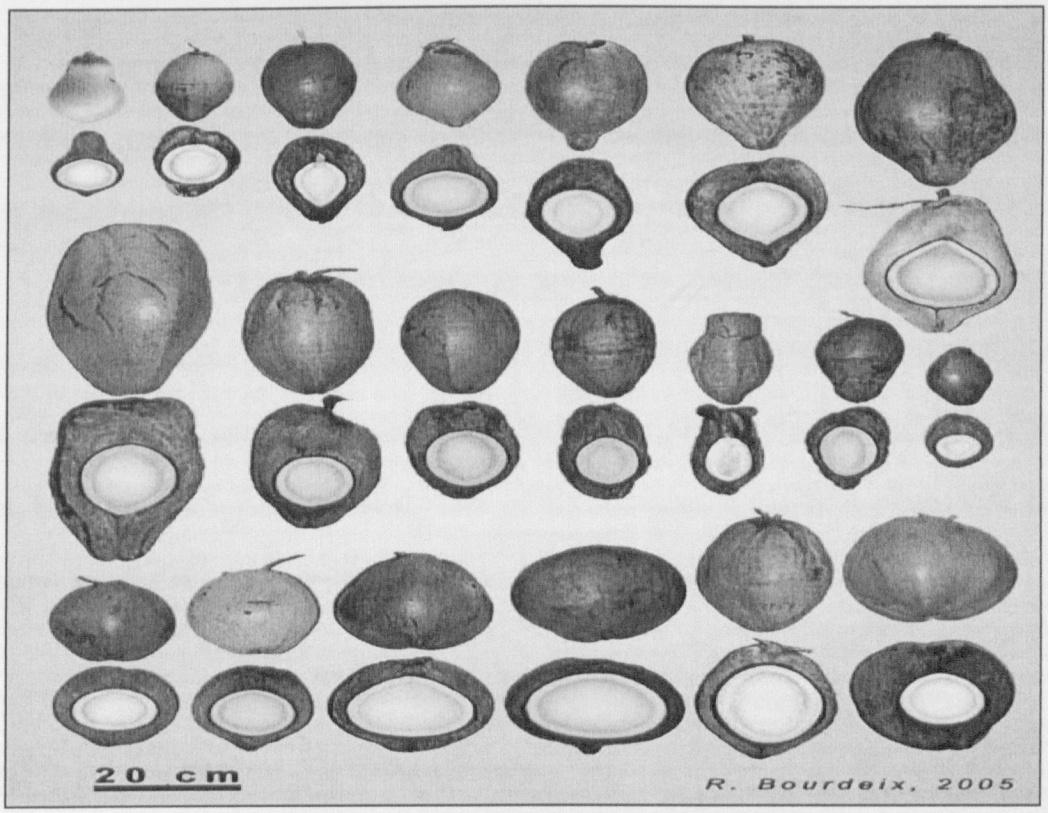

Figure 2.1 (a): Wide Range of Coconut Types and Varieties[3]

Top row

1. 'Papua Yellow Dwarf', PNG
2. 'Tahiti Red Dwarf', French Polynesia (Côte d'Ivoire)
3. 'Madang Brown Dwarf', PNG (Côte d'Ivoire)
4. 'Cameroon Red Dwarf', Cameroon (Côte d'Ivoire)
5. 'Spicata Tall', Samoa
6. 'Rotuman Tall', Fiji (Côte d'Ivoire)
7. 'Rennell Tall', Solomon Islands (Côte d'Ivoire)

Middle row

1. 'Niu Afa Tall', Samoa
2. 'Comoro Moheli Tall', Comoro Island (Côte d'Ivoire)
3. 'Sri Lanka Tall', Ambakelle, Sri Lanka (Côte d'Ivoire)
4. 'West African Tall', Akabo, Côte d'Ivoire
5. 'Tuvalu Tall', Fuafatu, Tuvalu
6. 'West African Tall', Mensah, Côte d'Ivoire
7. 'Miccro Laccadives Tall', India (Côte d'Ivoire)

Bottom row

1. 'Vanuatu Tall', Vanuatu (Vanuatu)
2. 'Malayan Yellow Dwarf', Malaysia (Côte d'Ivoire)
3. 'Malayan Tall', Malaysia (Côte d'Ivoire)
4. 'Tagnanan Tall', Philippines (Côte d'Ivoire)
5. 'Tampakan Tall', Philippines (the Philippines)
6. 'Kappadam Tall', India (Côte d'Ivoire)

Figure 2.1(b) List of Coconut Name from Left to Right[3]

Figure 2.1(a) shows wide range of coconut types and varieties that can be found around the world. From what can be seen from the figure, each coconut has different sizes and shapes. The color of the coconut skin also varies from type to type.

Meanwhile, Figure 2.1(b) shows the name of the coconut shown in figure 2.1(a). Most of these coconuts are named based on their family name and origin they founded. The dwarf family usually produces small fruit while tall family usually big and thick fruit. Even there are variation in the size of the coconuts, it can be assumed that every coconut meats have the same taste color and hardness regardless to its family.

2.2.3 Coconut Nutrition Facts

Coconut contains Calcium, Protein, Vitamins and other minerals which are needed by human being. [17] Table 2.1 shows the nutrition facts of grated coconut. Even though coconut milk is known high in cholesterol and fat, but with proper intake such as adequate amount of it just for flavoring, will bring more benefit than its drawback. Besides it will give good taste to the food.

As shown in the table, grated coconut is high in calcium which is good for bones and tissue development. It also can provide energy and at the same time gives moisture to the body. These elements are good for those who work in the hot tropical country to avoid dehydration and exhaustion. This source is courtesy of Thai Food Composition Tables (1999). Institute of Nutrition, Mahidol University.

Table 2.1: Grated Meat Coconut's Nutrition Facts[17]

Nutrients	Unit	Thai RDI*	Composition of coconut products
N (c)		2 (11)	1
Ash	Gram	0.5	53.5
Moisture (Water)	Gram	84.4	326
Energy (Enerc)	Kilo Calories	61	3.5
Protein (Procnt)	Gram	50**	28.7
Fat	Gram	65**	13.3
Total available CHO (Chocdf) include FIBTG	Gram	300**	-
Dietary	Gram	25	1.0
Calcium (Ca)	Milligram	800	-
Phosphorus (P)	Milligram	800	7.8
Iron (Fe)	Milligram	15	1.9
Sodium (Na)	Milligram	2400	-
Potassium (K)	Milligram	3500	-
Copper (Cu)	Milligram	2	-
Zinc (Zn)	Milligram	15	-
Vitamin A (Retinol)	µ Gram	-	-
ß-Carotene (Cartb)	µ Gram	-	-
Total vitamin A (Retinol- Equivalent, RE)	µ Gram	800	-
Vitamin B1 (ThiA)	Milligram	1.5	0.02
Vitamin B2 (Ribf)	Milligram	1.7	0.05
Niacin (NIA)	Milligram	20**	1.5
Vitamin C (VitC)	Milligram	60	11

Percentage of Thai Recommended Daily Intake is based on a 2,000 kcal diet.
* %Energy distribution from protein, total fat and carbohydrate = 10:30:60, Total Saturated at = 10% of total energy.
ource: Thai Food Composition Tables (1999), Institute of Nutrition, Mahidol University (INMU).

2.3 Market Study

2.3.1 Coconut Producers and Exporters

Coconut is planted in more than 90 countries worldwide. Total world coconut area in 1996 was estimated at 11 million hectares.[16] About 93 percent of the area was found in the Asian and Pacific regions as shown in Table 2.1.[16]Indonesia and Philippines are the major countries that produce the maximum coconut fruits in the world. The leading producers of the crop in the year 2005 with their production figures are mentioned in the list below.

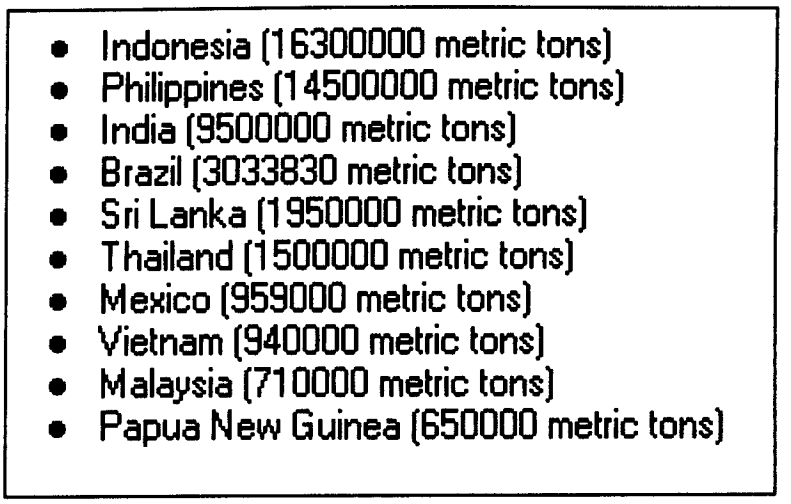

Figure 2.2: Lists of Exporters of Raw Coconut [1]

From Figure 2.2, Indonesia and Philippines exports 16300000 metric tons and 14500000 metric tons respectively. India is the third largest producer and produces 9500000 metric tons annually. The top two countries are serious competitors for the first position in the list. But since last few years the production in Philippines is decreasing gradually [1]